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CONTRIBUTIONS TO ENTOMOLOGY

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Research Article

A new genus and a new species of railroad-worm beetles from Bolivia (Coleoptera, Phengodidae, Mastinocerinae)

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Abstract

Here I describe a new genus, *Geiserocerus* **gen. nov.**, based on a single species, *Geiserocerus flavifrons* **sp. nov.**, from Parque Nacional Amboró, Santa Cruz, Bolívia. This new genus can be easily separated from most Mastinocerinae genera by the presence of a ventral comb in the pro- and mesotarsomere I and by the medial teeth of the mandibles. I provide a modified key to Mastinocerinae genera with 12-segmented antennae and the pro- and mesotarsomere I with ventral combs, as well as illustrations of the diagnostic features for this new genus. Finally, I discuss the genus similarities with other phengodid genera in order to hypothesize the genus relationships in the family.

Key Words

Amboro, biodiversity, distribution, morphology, neotropical, systematics, taxonomy

Introduction

Phengodidae LeConte, 1861 are composed of around 300 species and 40 genera. The family is divided into four subfamilies, distributed in the Americas, from southern Canada to northern Chile–Argentina, and in the Levant, Asia Minor and Iran (Zagaroza-Caballero and Pérez-Hernández 2014; Kundrata et al. 2019; Roza 2023; Ferreira et al. 2024). The group was already present at least in the Mesozoic, with a fossil known from Burmese amber (Roza et al. 2023). The known species distributions in the family are currently biased, with more than a third of its richness described for Mexico and Brazil, countries where there is a history of taxonomical study of this group. The study of phengodids is affected by a taxonomic impediment, and many new taxa remain to be described. Six new genera and several new species were described in the past decade alone (eg. Roza et al. 2017, 2018; Roza and Mermudes 2019, 2020; Coelho et al. 2024; Vega-Badillo et al. 2020, 2023; Roza 2023).

Among the countries of the Neotropical region, Bolivia stands out with its great amount of geological formations and vegetational types, its rich biodiversity and by the good conservation status of most of its ecosystems (Ibsch 2005). It is, however, one of the Neotropical countries with the smallest number of Phengodidae species, with only 13 species recorded (Zaragoza-Caballero and Pérez-Hernández 2014). This highlights the urgent need for new studies focusing on characterizing the family biodiversity in the country.

In this context, I herein describe a new genus and a new species, based on specimens from a site with heterogeneous vegetation combining several Bolivian biomes. I also provide a distributional map and a modified key (based on Zagaroza-Caballero and Pérez-Hernández (2014) and Roza (2023)) to distinguish the new genus from morphologically similar genera.

Material and methods

Specimens examined in this study were deposited at the Natural History Museum, London, UK (**BMNH**), and were sent on loan by Michael Geiser (Coleoptera curator). One of the paratypes will be retained in the Coleção Entomológica Professor José Alfredo Pinheiro Dutra, Universidade Federal do Rio de Janeiro, Brazil (**DZRJ**). Labels are cited in the following manner: lines on the same label are separated by a slash '/', separate labels are indicated by a double backslash '\\'. Additional information provided by the author appears between square brackets '[]'. Words printed on labels in full capital letters are transcribed as such. Specimen count appears after label information between parentheses. Collection acronyms appear after all labels for the specimens. Country (bold capital letters) and province/state (lowcase italic) information appears before label information.

The terminology follows Costa and Zaragoza–Caballero (2010) and Roza (2023). For hind wings, we follow Lawrence et al. (2021). One paratype had the entire body dissected and preserved in a glycerin vial. Photographs and measurements were taken with the Leica DFC450 and Application Suite CV3 multifocus software. The photographs were edited using Adobe Photoshop and the plates were designed with Adobe Illustrator (Adobe Systems). Total length was given by the sum of lateral head, thorax and abdominal (up to hind wing apex) lengths, because extracting only overall body size could be misleading due to pronotal and head declination.

Results

Systematics

Phengodidae LeConte, 1861
Mastinocerinae LeConte, 1881

Key to the identification of Mastinocerinae genera with 12-segmented antennae and pro- and mesotarsomeres I bearing ventral combs

Adapted from Zaragoza-Caballero and Pérez-Hernández (2014) and Roza (2023), with modifications on couplet 13 and the addition of a new couplet:

12	Only the first pro- and mesotarsomere with ventral combs	**13**
13	Mandibles without additional teeth	**14**
13'	Mandibles with additional teeth	**13a**
13a	Eyes large, covering almost the entire head in lateral view, approximate by less than an eye width in ventral view; antennomere XII cylindrical; paramere symmetrical	***Pseudomastinocerus* Wittmer**
13b	Eyes small, covering around half of head in lateral view (Figs 1D, 2C), approximate by more than 2× the eye width in ventral view (Fig. 2B); antennomere XII claviform (Fig. 2I); paramere slightly asymmetrical (Fig. 5G)	***Geiserocerus* gen. nov.**
14	Posterior pronotal margin continuous	**15**
14'	Posterior pronotal margin discontinuous	***Phrixothrix* Olivier**
15	Antennomere 4–11 bipectinate	**16**
15'	Antennomere 4–10 bipectinate, 11 enlarged and without branches	***Eurymastinocerus* Wittmer**
16	Tarsal combs as long as tarsus length	**17**
16'	Tarsal combs as long as half of tarsus length	**16a**
16a	Labial palpi with two palpomere; tarsomere II 0.5× of tarsomere I length	***Iviephengus* Roza**
16b	Labial palpi with three palpomere; tarsomere II subequal to tarsomere I length	***Cephalophrixothrix* Wittmer**
17	Tarsal claws simple, without teeth	**18**
17'	Tarsal claws with thin teeth on base	***Ptorthodius* Gorham**
18	Labial palpi with three palpomeres	**19**
18'	Labial palpi with two palpomeres	***Mastinomorphus* Wittmer**
19	Two large and uneven tentorial pits; clypeus not projected; labrum dorsally visible	***Mastinocerus* (*Mastinocerus*) Solier**
19'	A single tentorial pit; clypeus projected; labrum not visible dorsally	***Mastinocerus* (*Paramastinocerus*) Wittmer**

Geiserocerus gen. nov.

https://zoobank.org/5DED8F7F-5959-4DCF-9080-10A6686CB3C6

Figs 1–6

Type species. *Geiserocerus flavifrons* sp. nov., here designated.

Etymology. The name is in honor of the entomologist Michael Geiser, a great coleopterist researcher who largely contributed to the knowledge of world beetles, with a large focus on morphology and taxonomy of soft-bodied families. Michael kindly loaned me several Phengodidae specimens from the BMNH. Singular genitive, masculine.

Diagnosis. Antenna with 12 antennomeres, antennomeres IV–XI with two short symmetrical compressed and fusiform branches, slightly longer than respective antennomere, antennomere XII claviform (Fig. 2I); interantennal distance close to 3× antennal socket width (Figs 1C, 2D); labrum fused to frontoclypeus (Figs 1C, 2A); mandibles short, bent almost in a right angle near base, not projected, obliquely crossed over each other, without a notch on external margin to fit other mandible and with extra medial teeth with rhomboid apex (Fig. 2H); maxillary palpi 4-segmented, last segment digitiform (Fig. 2F); labial palpi 3-segmented (Fig. 2G); one gular suture and posterior tentorial pit consisting of a single small fossa (Fig. 1B); elytron around 3× as long as wide, external margin slightly curved and convergent with the other elytron posteriorly, slightly thickened apically (Fig. 4A); wing with radial cell open and transverse, vein r4 interrupted, r3 absent (Fig. 4C); first tarsomere of pro- and mesotarsus with a ventral comb covering the entire tarsomere (Fig. 2J); claws simple, without visible teeth (Fig. 2J); aedeagus with paramere slightly asymmetrical, paramere apex unevenly round, toothed inward, with short and scarce bristles (Fig. 5G–I).

Description. Male. ***Head*** **(Figs 1C, D, 2).** Head slightly wider than long, with posterior half of lateral margin sinuous, slightly convergent posteriorly, apical fourth usually covered by pronotum, slightly wider than pronotum (Figs 1C, 2A); antenna 1.5× as long as head width, with 12 antennomeres, antennomeres IV–XI with two short symmetrical compressed and fusiform branches, slightly longer than respective antennomeres, antennomere XII claviform (Fig. 2I); eyes not protruding, coarsely faceted (Fig. 1C, D), frontoclypeus with a subtle declivity between antennae, from interantennal area up to anterior margin of labrum (Fig. 2C), interantennal distance close to 3× antennal socket width (Figs 1C, 2D); labrum fused with frontoclypeus, bilobate by a median emargination on anterior margin (Figs 1C, 2A); mandible short, bent almost in a right angle near base, not projected, obliquely crossed over each other, without a notch on external margin to fit other mandible and with extra medial teeth with rhomboid apex (Fig. 2H); maxilla with palpi 4-segmented, last palpomere digitiform, palpifer distinct, galea distinct, extremely short and free, highly setose, lacinia almost fused with stipe, highly setose, cardo semitriangular, 2× wider than long (Fig. 2F); labium with palpi 3-segmented, short, not covered by mandibles, last palpomere fusiform, ligula absent, prementum quadrate, palpiger absent, mentum and submentum fused in a single piece, which is fused with head (Fig. 2B, G); one gular suture, tentorial pit consisting of a single small fossa (Fig. 2B).

Thorax **(Figs 1C, 3).** Pronotum quadrate, slightly wider than long, anterior angles dorsally concave, rounded, lateral margins subparallel, posterior margin rounded (Fig. 3A); hypomeron densely setose in anterior half, glabrous in posterior half, transverse in lateral view (2× as long as high), with ventral margin straight up to middle, then oblique until posterior margin of pronotum (Fig. 3D); prosternum 2× as wide as its major length, narrowed parasagittally (Fig. 3B); proendosternite elongated, about as long as distance between the apices of proendosternite arms (Fig. 3C); mesoscutellum fused with mesoscutum, slightly concave in lateral view (Fig. 3D, E); alinotum subquadrate, glabrous, lateral margins subparallel, posterior margin straight, scutum—prescutalplates sclerotized, extending ridges almost to posterior margin (Fig. 3E, F); mesoventrite weakly sclerotized, blunt medially, mesepimeron fused to mesoventrite, mesanepisternum-mesepimeron suture conspicuous (Fig. 3H); metaventrite depressed anteriorly (mesocoxal rests), discrimen distinct by basal half, lateral margins subparallel up to lateral-most part of metacoxa, then convergent posteriorly, posterior margin rounded (Fig. 3H); mesendosternite with two parasagittal thin projections directed upwards (Fig. 3I); metendosternite diamond-shaped, spatulate, 5× as long as wide, median projection acute anteriad, with two small lateral laminae (Fig. 3I); elytron wider in anterior half, slightly convergent posteriorly, subparallel, apex slightly swollen (Fig. 4A); posterior wings with radial cell open and transversal, around 2.5× wider than long, r4 interrupted both in radial cell and RP, r3 absent, RP reaching one third of MP1+2 length, medial field containing five main veins: MP3, MP4, CuA1, CAS and AA4; CuA2 absent, anal lobe well developed, AP3+4 long, J absent (Fig. 4C); legs increasing in length from pro- to metaleg, pro- and mesotarsomere I with a ventral comb covering the entire tarsomere (Fig. 3J); tarsomere I 2× longer than tarsomere II, tarsomeres II–IV decreasing in length, tarsomere IV in all legs of 1/2 length of tarsomere V, claws simple, without any visible teeth (Fig. 3J).

Abdomen **(Fig. 5).** Subparallel, tergites and ventrites extremely transverse, around 3–4× wider than long, slightly increasing in length, tergite VIII as wide as long; tergites with anterior margin deeply emarginate, lateral margins subparallel, posterior margin straight to slightly rounded (Fig. 5A); tergite VII with a fringe of microsetae on posterior margin (Fig. 5C); tergite IX transversal, with a membranous division in middle, anterior margin oblique inward, posterior margin innerly curved; tergite X short, conical, lateral margins subparallel (Fig. 5E); sternites with anterior margin straight, lateral margins subparallel, posterior margin straight to slightly rounded (Fig. 5B), sternite VIII with a membranous, densely setose projection on anterior margin (Fig. 5D), sternite IX elongate, posterior margin slightly emarginate (Fig. 5F);

Figure 1. *Geiserocerus flavifrons* gen. nov. et sp. nov., holotype: **A.** Habitus, dorsal; **B.** Habitus, lateral; **C.** Head and pronotum, dorsal. **D.** Head, lateral.

aedeagus trilobed, phallobase attached to median lobe, slightly sclerotized, and shaped as a ribbon-like stripe, median lobe cylindrical, strongly curved at base, rounded apically; flagellum encircled around median lobe at rest; about 2× longer than median lobe length; parameres slightly asymmetrical, narrowing slightly past middle towards apex, which is unevenly round, toothed inward, with short and scarce bristles (Fig. 5G–I).

Length. 4.55 to 5.50 mm.

Female and immature stages. Unknown.

Remarks. *Geiserocerus* gen. nov. can be easily separated from most of the genera of Mastinocerinae by the presence of a ventral comb in the pro- and mesotarsomere I. When compared with other genera with the pro- and mesotarsomere I ventral combs, it can be separated from all of them, with the exception of *Pseudomastinocerus* Wittmer, 1963, by the medial teeth on mandible. It can be differentiated from *Pseudomastinocerus* by the small eyes, covering around half of head in lateral view (eyes large, covering almost the entire head in lateral view in *Pseudomastinocerus*), separated by more than 2× the eye width in ventral view (separated by less than an eye width in ventral view in *Pseudomastinocerus*), antennomere XII claviform (cylindrical in *Pseudomastinocerus*) and paramere slightly asymmetrical (paramere symmetrical in *Pseudomastinocerus*).

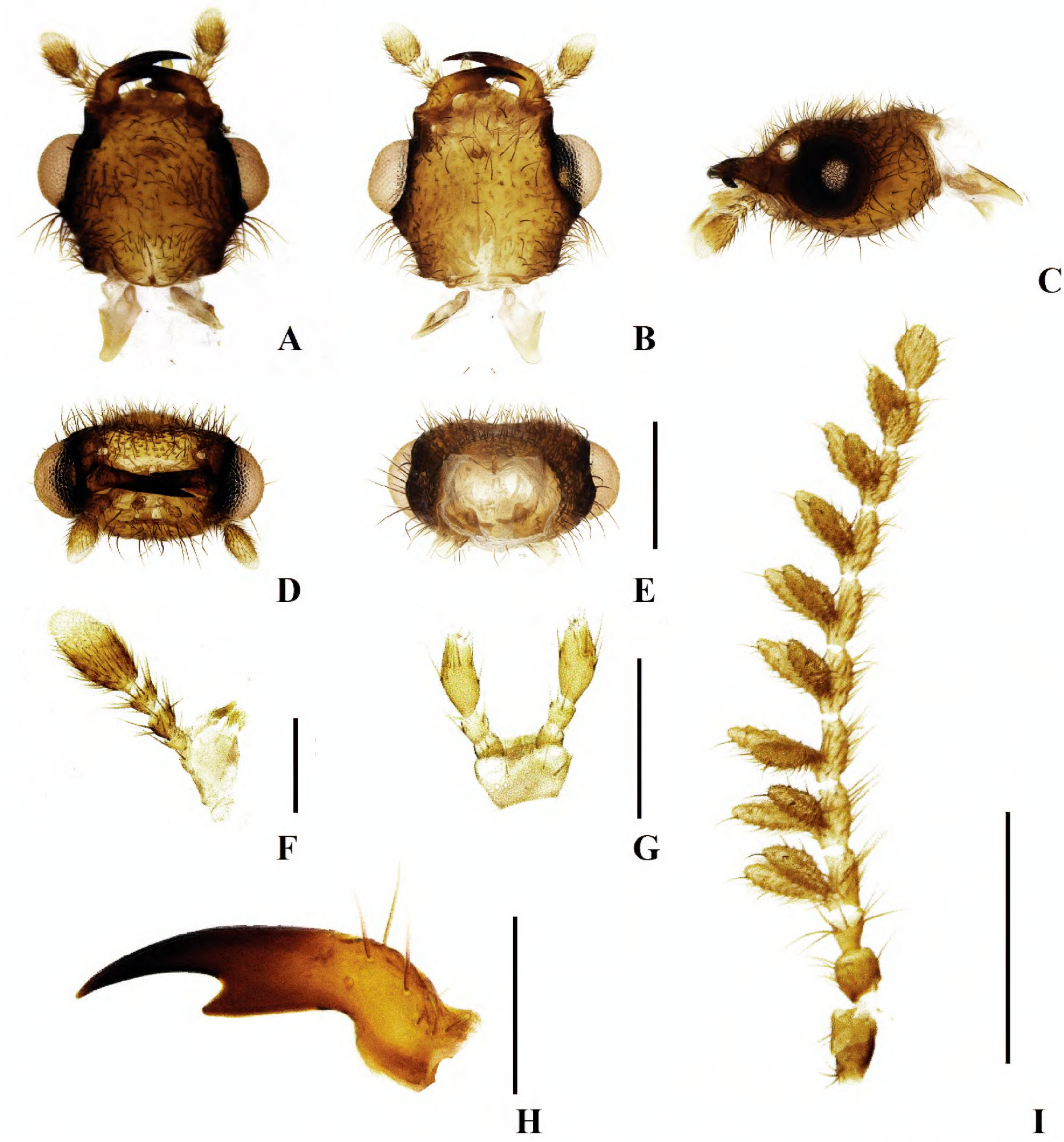

Figure 2. *Geiserocerus flavifrons* gen. nov. et sp. nov., paratype: **A.** Head, dorsal; **B.** Head, ventral; **C.** Head, lateral; **D.** Head, frontal; **E.** Head, posterior; **F.** Maxilla, ventral; **G.** Labium, ventral; **H.** Right mandible, dorsal; **I.** Antenna, lateral.

***Geiserocerus flavifrons* sp. nov.**

https://zoobank.org/BFB84D60-FC4F-4B3E-A40F-CF67CCE239D8

Figs 1–6

Etymology. A combination of the Latin adjective *flavus*, "yellow", and feminine noun *frons*, "forehead", in reference to the yellowish coloration present on the anterior region of the head of the specimens of this species. Name in apposition.

Type locality. Los Volcanes refugee, Amboro National Park, Santa Cruz, Bolívia.

Diagnosis. Body overall brown to dark brown, with light brown antennae and yellow to yellowish brown head dorsally and ventrally (anterior region to almost the

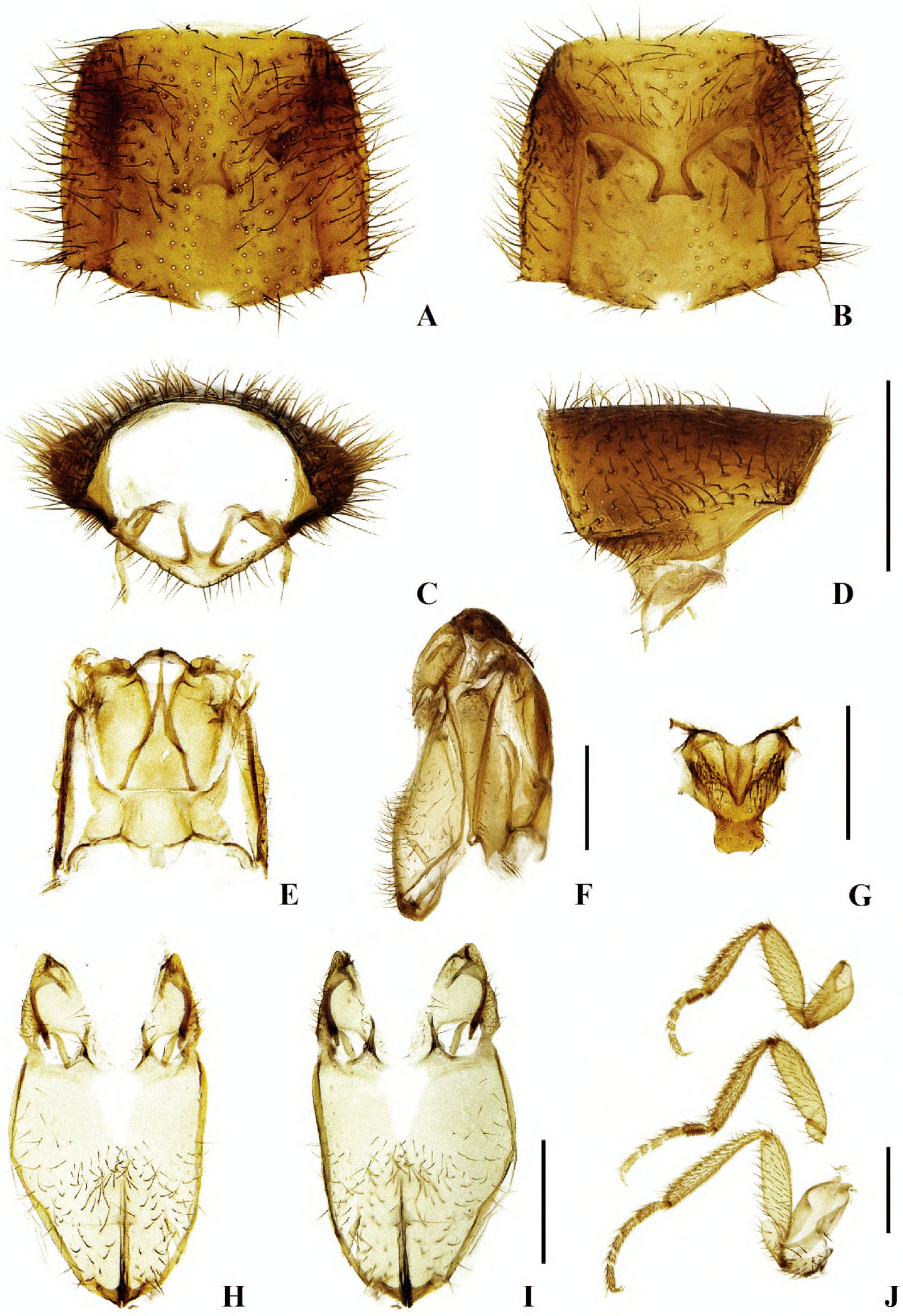

Figure 3. *Geiserocerus flavifrons* gen. nov. et sp. nov., paratype: **A.** Prothorax, dorsal; **B.** Prothorax, ventral; **C.** Prothorax, frontal; **D.** Prothorax, lateral; **E.** Meso- and metathorax, dorsal; **F.** Meso- and metathorax, lateral; **G.** Metascutum and metascutellum, dorsal; **H.** Meso- and metathorax, ventral; **I.** Meso- and metaventrite, dorsal; **J.** Pro-, meso-, and metaleg, from top to bottom, respectively.

entire head, varying between specimens), prosternum, mesosternum, legs and aedeagus (Fig. 1A, B). Eyes occupying almost 1/6 of head width in dorsal view (Figs 1C, 2A); in lateral view, posterior margin vertical, straight (Figs 1D, 2C). Antennomere IV 1.5× as long as III, crescent until VIII, IX subequal to VIII and X–XI slightly decrescent, XII subequal to XI (Fig. 2I). Pronotum slightly wider than long, anterior margin rounded, posterior margin slightly curved (Figs 1C, 3A). Elytron around 3× as long as wide (Fig. 4A).

Description. Male. Measurements (n = 6): Total length: 4.55–5.50 mm (aver. 4.90 mm, 5.50 mm in holotype). Head length: 0.59–0.66 mm (aver. 0.61 mm, 0.57 mm in holotype). Head width: 0.84–0.90 mm (aver. 0.88 mm, 0.89 mm in holotype). Pronotum length: 0.69–0.76 mm (aver. 0.73 mm, 0.74 in holotype). Pronotum maximum width: 0.74–0.83 (aver. 0.81 mm, 0.82 in holotype). Elytron length: 1.56–1.62 mm (aver. 1.58 mm, 1.56 mm in holotype). Elytron maximum width: 0.48–0.51 mm (aver. 0.50 mm, 0.48 in holotype).

Morphology: Head slightly wider than long, integument glossy, smooth, coarsely punctate, eyes small, feebly protruding, occupying around 1/6 of the width in dorsal view (Figs 1C, 2A) post-ocular area subequal to eye length in lateral view, posterior margin straight, straight (Figs 1D, 2C); antennomere IV 1.5× as long as III, crescent until VIII, IX subequal to VIII and X–XI slightly decrescent, XII subequal to XI (Fig. 2J); maxilla with last palpomere as long as the three preceding ones combined (Fig. 2F); labium with last palpomere 1.5× as long as the two preceding ones (Fig. 2G). Pronotum slightly wider than long, integument glossy, smooth, coarsely punctured, anterior margin rounded, lateral margins dorsally subparallels, slightly convergent anteriorly, posterior margin slightly curved (Figs 1C, 3A). Elytron heavily setigerous punctate, around 3× as long as wide (Fig. 4A). Posterior wings with venation as in the genus description (Fig. 4C). Tergite IX transversal, 2× as wide as long in the middle line; tergite X 2× as long as wide (Fig. 5E); Sternite VIII with posterior margin slightly marginated (Fig. 5D); sternite IX almost 2× as long as wide when including membranous area, posterior margin distinctly emarginate (Fig. 5F). Aedeagus with phallobase sclerotized, transverse and shaped as a ribbon-like stripe, medially separated; median lobe cylindrical, strongly curved at base, rounded and not constricted apically, flagellum encircled around median lobe at rest; about 2× as long as median lobe length, with serration in the apical half; paramere parallels, slightly asymmetrical, narrowing slightly past the middle towards the apex, which is truncate, toothed innard, with short and scarce bristles (Fig. 5G–I).

Coloration. Body overall brown to dark brown, with light brown antennae, brown to yellowish brown head dorsally and ventrally (anterior region to almost the entire head, varying between specimens – yellowish brown in the anterior half, medially yellowish brown and laterally brown in the posterior half of the holotype), yellowish light brown prosternum, mesosternum, legs and aedeagus (Fig. 1A, B).

Immatures and females. Unknown.

Biology and distribution. *Geiserocerus flavifrons* sp. nov. is only known to occur in the Parque Nacional Amboró, Santa Cruz, Bolívia (Fig. 6). The National park is a region where four major biomes come into contact:

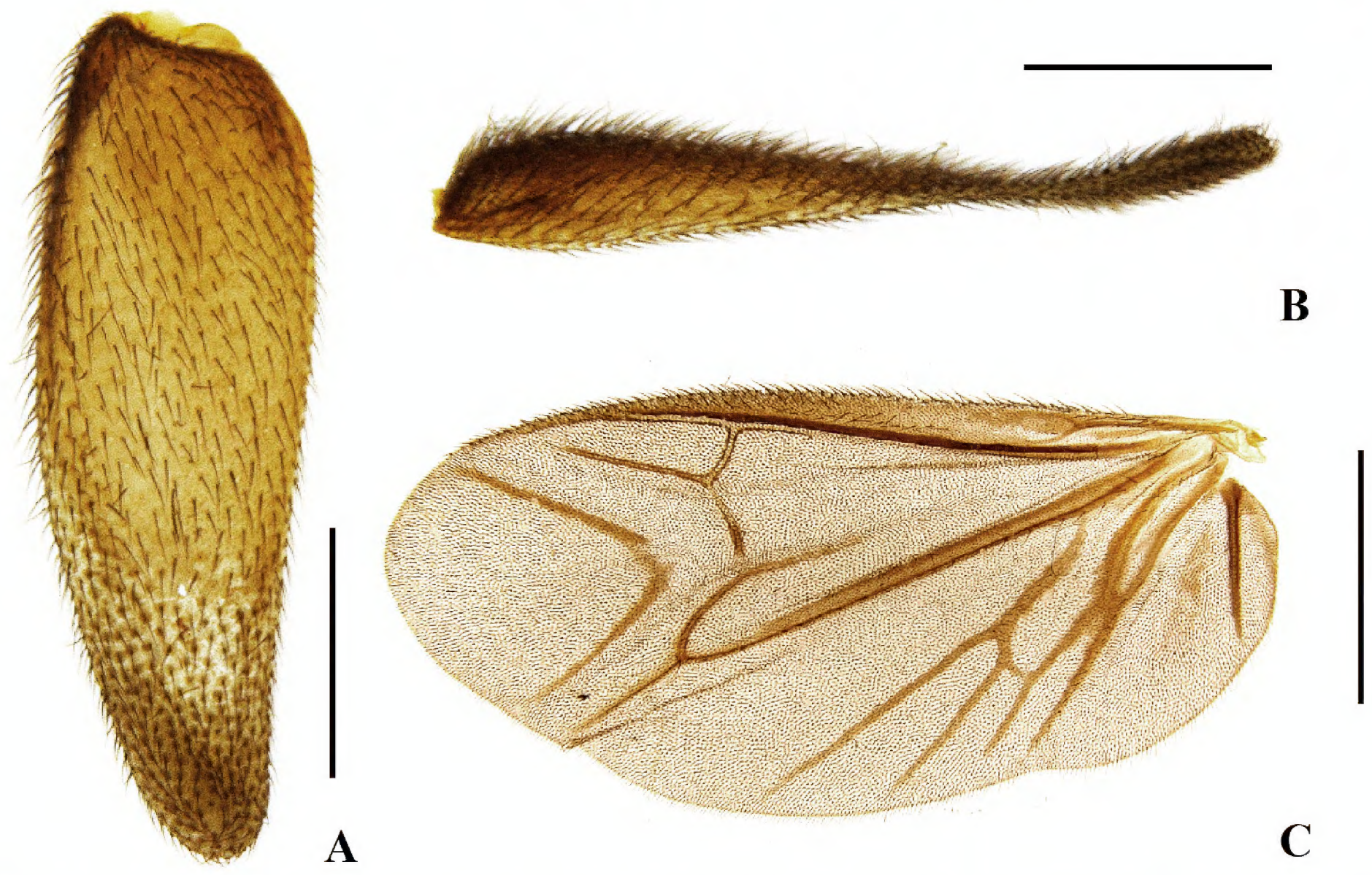

Figure 4. *Geiserocerus flavifrons* gen. nov. et sp. nov., paratype: **A.** Left elytron, dorsal; Left elytron, lateral; **C.** Left wing, dorsal.

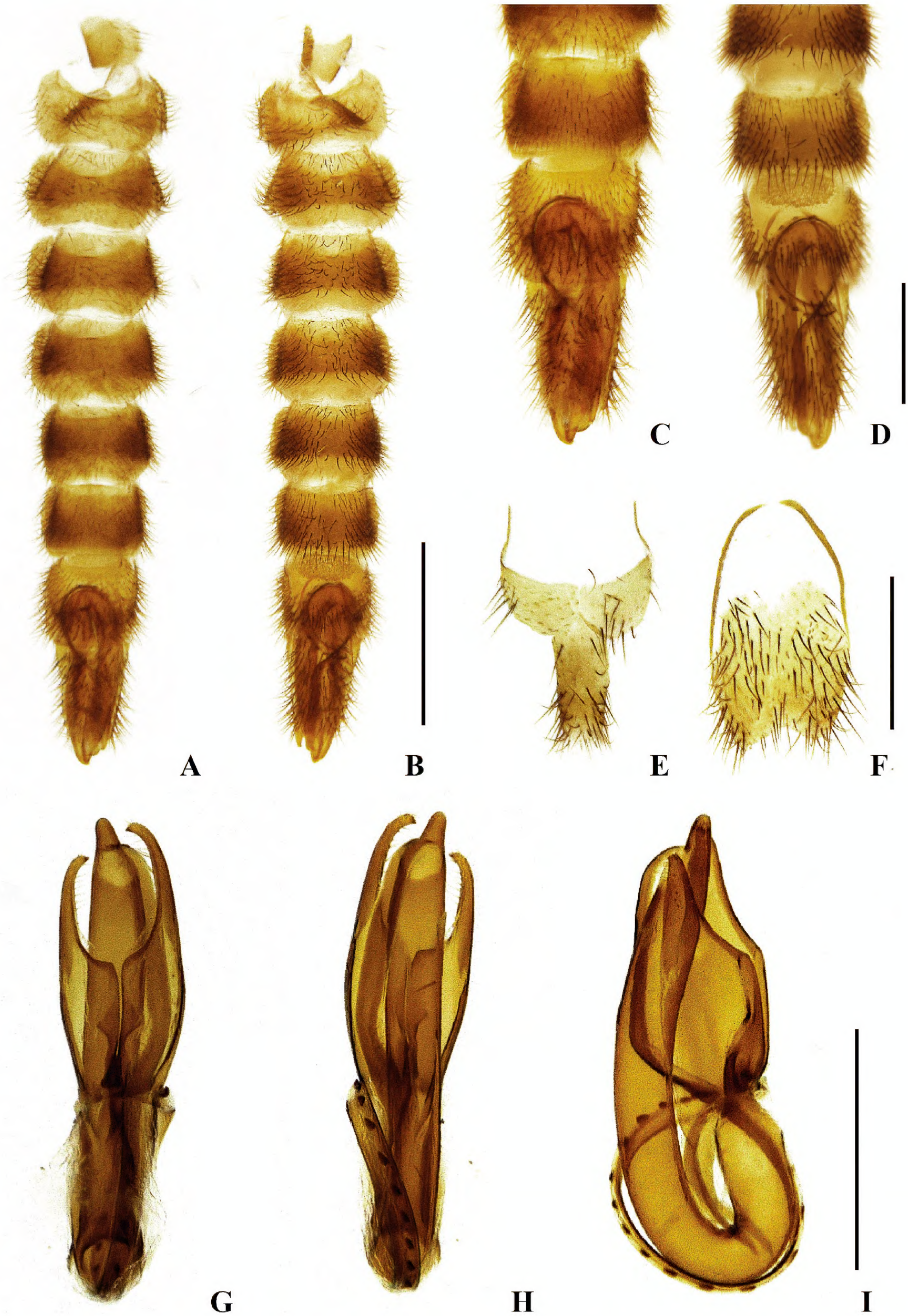

Figure 5. *Geiserocerus flavifrons* gen. nov. et sp. nov., paratype: **A.** Abdomen, dorsal; **B.** Abdomen, ventral; **C.** Abdominal sternites VII–IX, dorsal; **D.** Abdominal sternites VII–IX, ventral; **E.** Abdominal tergites IX and X, dorsal; **F.** Abdominal sternite IX, ventral; **G.** Aedeagus, dorsal; **H.** Aedeagus, ventral; **I.** Aedeagus, lateral.

Figure 6. Distribution of *Geiserocerus flavifrons* gen. nov. et sp. nov. Type locality marked in pink.

the humid vegetation from Amazonia, the seasonal subtropical lowland vegetation from the Chaco, the subtropical highland vegetation from the Andes and the seasonal vegetation of the Chiquitanía (Ibisch et al. 2003). The specific site of the sampling, Los Volcones refugee, has a heterogeneous phytophysiognomy, being composed of elements belonging to seasonal forests as well as to humid tropical forests (Linares-Palomino et al. 2008).

All specimens were collected between November and December, by the end of the spring and beginning of the summer in the southern hemisphere. Species of this genus were never seen alive, so there is no data regarding their habits.

Type material. ***Holotype*: BOLIVIA.** Santa Cruz. BOLIVIA: Santa Cruz/ Amboro National Park/ Los Volcanes, c. 1000m/ S18°06' W63°36'/ 20/xi-12/xii/2004\\ Flight Intercept Trap/ Mendel, H. &/ Barclay, M. V. L./ BMNH(E)2004-280\\ Geiserocerus/ flavifrons/ HOLOTYPE/ det. Roza, A.S. (1 male) (BMNH). ***Paratypes*:** Santa Cruz. BOLIVIA: Same data as holotype except last label: Geiserocerus/ flavifrons/ PARATYPE/ det. Roza, A.S. (2 males) (BMNH), (1 male) (DZRJ); Santa Cruz/ Amboro National Park/ Los Volcanes, c. 1000m/ S18°06' W63°36'/ 20/xi-12/xii/2004\\ Flight Intercept Trap/ Mendel, H. &/ Barclay, M. V. L./ iBMNH(E)2004-280\\ *Eurymastinocerus* sp./ Quintino, H. Y. S. det 2017\\ Geiserocerus/ flavifrons/ PARATYPE/ det. Roza, A.S. and a (1 male) (BMNH); Santa Cruz/ Amboro National Park/ Los Volcanes, c. 1000m/ S18°06' W63°36'/ 20/xi-12/xii/2004\\ Flight Intercept Trap/ Mendel, H. &/ Barclay, M. V. L./ BMNH(E)2004-280\\ Phengodidae/ det E. Jiménez-Sánchez 2006\\ Geiserocerus/ flavifrons/ PARATYPE/ det. Roza, A.S. and a (1 male) (BMNH).

Discussion

Geiserocerus flavifrons sp. nov. is the 14th Phengodidae species to be recorded in Bolivia, thus improving the current knowledge for the family in the taxonomically poorly known country. Although the genus is herein described as endemic to the country, it is more likely that many other species, from different locations, lurk within natural history collections, waiting to be discovered and described. Therefore, the apparent endemism of the genus can be an artifact of lack of sampling or examination of collections.

This new genus is very similar to three other genera, which will hereafter be referred to as the *Euryopa*-complex: *Euryopa* Gorham, 1888 *Eurymastinocerus* Wittmer, 1976 and *Euryognathus* Wittmer, 1976. All of these genera are characterized by short antennae, with length as long as 1.5× the head width, antennomere XII claviform, antennomere branches covered by white minute setae in the internal surface, and eyes coarsely faceted,

with ommatidia large and interommatidia distinct (pers. observ.). *Geiserocerus* gen. nov. can be easily distinguished from the other genera by the mandible with a medial tooth (*Euryognathus* possess a median rhomboid projection, not similar with *Geiserocerus* gen. nov. teeth). It can be further differentiated from *Euryopa* and *Euryognathus* by the antenna with 12 antennomere (11 in both genera) and from *Eurymastinocerus* by the antennomere XI with branches (antennomere XI enlarged and without branches in *Eurymastinocerus*).

The *Euryopa*-complex has been found as a monophyletic clade in the most recent analysis, based on phylogenomic data (Ferreira et al. 2024). In addition to that, *Euryopa* has been found as polyphyletic with both phylogenomic and morphological data (Quintino 2017; Ferreira et al. 2024). In this sense, we hope that descriptions of other related taxa, like the genus described here, might help to elucidate the generic limits and relationships within this group of genera.

Acknowledgements

I thank Michael Geiser (Coleoptera curator, Natural History Museum, London) for all the assistance and the loan of the specimens examined in this study. I acknowledge the Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ) for the personal funding (proc. 205.818/2022 and 205.819/2022) and for the photographic system acquired through grant (proc. 110.040/2014).

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